

Recruitment in an Eastern Screech Owl *Otus asio* Population: on Components of Fitness and Inheritance

Frederick R. Gehlbach

INTRODUCTION

Since 1967 I have studied the life history and population ecology of Eastern Screech Owls (*Otus asio*) in suburban Waco, Texas, USA, and a nearby rural environment (Gehlbach 1988, 1989). The investigations focussed on comparative aspects related to the cultural versus rural settings. They were intensive in that 20 nest boxes, all natural cavities, and 2km-wide perimeter zones around study plots were used to learn about behaviour, demography, dispersal, life-history strategy, lifetime reproduction, etc. of the owls in 270ha plots at each site. The 1967-1975 period was strictly exploratory, a time to eliminate biases by perfecting techniques, so a confirmatory study could assess four generations of the owls during 1976-1987.

RESULTS

Beginning in 1988, only the suburban population has been monitored, and this account deals entirely with it, employing data on 16 suburban recruits that first nested as yearlings between 1976 and 1991. Overall, 17 of 272 suburban fledglings and one of 58 from the rural population became breeders in suburbia. Two other suburban owlets bred six and 13km from the plot and perimeter zone. The 6 % recovery rate is the highest reported among owls (e.g. Southern 1970; Van Camp & Henny 1975; Korpimäki & Lagerstrom 1988). Besides the recruits, I will note some features of their mothers and environments, pertinent to understanding their recruitment.

Mothers of Recruits

Sixteen owlets that became suburban breeders originated in the initial annual nests of only 10 females (12 % out of 80), all of which were long-lived (2-9 years). One produced four, another three, a third produced two, and the rest one recruit apiece. This strongly skewed distribution (1.43) and the limited number of involved females is evidence that only a few "quality" individuals reproduce successfully. Collectively, the 10 females furnished five recruits at age one, six at two,

and five at age three, hence breeding experience did not seem to matter. Also, number of recruits was unrelated to number of lifetime fledglings among the 10 or all 27 long-lived suburban females ($r < 0.37$, ns), contrary to my earlier report on a more limited data-set (Gehlbach 1989).

The recruit-producers used their nest sites as faithfully as all other long-lived females and were similar in other aspects of lifetime reproduction with three important exceptions. They averaged six grams larger ($P = 0.06$), began nesting a week earlier ($P = 0.01$), and were more efficient at fledging offspring from eggs ($P = 0.04$). Perhaps the critical link to recruitment is early nesting by larger females, because such nests generally contain larger clutches with larger eggs that hatch into larger nestlings which grow faster and fledge at larger sizes relative to later nests. Indeed, in a logistic stepwise regression early nesting accounts for more variation (26 %, $P = 0.01$) in recruit-making or not than the total of body mass and fledging efficiency (21 %, $P = 0.05$).

Recruits

Surely recruits come from early nests, because they permit early fledging and thus more time to learn self-sufficiency before dispersal, together with early settlement on home ranges before winter stress. That their mothers nest at larger sizes more efficiently suggests better nutrition, perhaps even better parental care; and, on average, recruits grew 0.3 g/day faster than 30 non-sibling members of their cohorts ($P = 0.07$). Also, they fledged two weeks earlier ($P = 0.01$) with 5g average advantage in body size ($P = 0.05$). In these regards they did not differ from siblings, and none of the owlets differed in hatching order or brood size.

When I regress number of recruits in each of their 10 cohorts on the environmental factors of their fledging years, population density explains 50 % of the variation and is a negative influent ($P = 0.05$) while food supply adds another 41 % to the total explanation and is positive ($P = 0.08$). Neither factor nor any weather parameter explains differences among years in which recruits first nest. Therefore, it is apparent that favourable conditions in the fledging year, not the first breeding year, are important to recruitment and in a density-dependent fashion.

Owlets originating in a sparse population amidst plentiful food are the most probable recruits, because they are less likely to be driven away and more likely to find vacant cavities for roosting and nesting plus sufficient food. Natal-dispersal distance is directly related to population density ($r = 0.65$, $P = 0.01$); and competitive pressure is apparent, as the Eastern Screech Owl is a permanent-resident, polyterritorial species. Natal dispersal averaged 2.7 (median 1.2) km in the suburban population.

Inheritance

Among long-lived suburban females, variation in all reproductive features except first-egg date declined before apparent senescence at five years of age ($P < 0.03$). Can this be due to stabilizing selection? To understand better the selective values of body mass, first-egg date, clutch size, number of fledglings, and production efficiency (fledglings/eggs), repeatability analyses were performed on these features of the 27 long-lived suburban females. Heritabilities of the same attributes among nine female recruits (yearlings) were analysed by regressing them on the yearling characteristics of their mothers.

Body mass has a significantly high repeatability (69 %, $P < 0.001$), nearly matched by its mean heritability (68 %), although all heritability values are insignificant, probably due to the small sample. The body-mass values are close enough to a 60 % estimate of female size attributable to variation other than food supply and mate attentiveness to underscore the importance of inherited size. The remaining four features also have significant ($P < 0.04$) but smaller repeatability and heritability values with number of fledglings being somewhat higher (37 %, 38 % respectively) than the others (19-35 %).

CONCLUSIONS

Recruitment into a breeding population apparently requires selectively advantageous reproductive features that are inherited. In particular, large body mass is selected for, because it also increases the chance of long-term survival (27 long-lived females were larger as yearlings than 19 contemporaries that did not survive beyond one year, $P = 0.03$). Recruit producing females are larger and more efficient breeders aside from the qualities of their mates. Thus they are able to raise larger offspring earlier, which are more likely to survive their early independence by finding food and housing locally. Long-distance dispersal over potentially inhospitable terrain is avoided.

A low-density population is also important to survival and the local settling of recruits through reduced intraspecific competition for resources; and a plentiful food supply simply augments recruitment, which is fostered primarily by available space in the natal population. Moreover, a low-density population is more likely to promote the genes of recruits which are proportionately more common, hence influential, among fewer nesting individuals.

ACKNOWLEDGEMENTS

This presentation is summarized from sections of three chapters in my manuscript on the life history and population ecology of Eastern Screech Owls. I thank my collaborators and Baylor University for their support, Robert Baldridge for reading this manuscript, and Erkki Korpimäki for inviting my participation in this symposium.

REFERENCES

- GEHLBACH, F.R. 1988. Population and environmental features that promote adaptation to urban ecosystems: the case of Eastern Screech Owls (*Otus asio*) in Texas. *Acta XIX Congr. Internatl. Ornithol.* 2: 1809-1813.
- GEHLBACH, F.R. 1989. Screech Owl. In I. Newton (Ed) *Lifetime Reproduction in Birds*. pp. 315-326 London: Academic Press.
- KORPIMÄKI, E. & M. LAGERSTROM 1988. Survival and natal dispersal of fledglings of Tengmalm's Owl in relation to fluctuating food conditions and hatching date. *J. Animal Ecol.* 57: 433-441.
- SOUTHERN, H.N. 1970. The natural control of a population of Tawny Owls (*Strix aluco*). *J. Zool. London* 162: 197-285.
- VAN CAMP, L.F. & C.J. HENNY 1975. The Screech Owl: its life history and population ecology in northern Ohio. *N. Amer. Fauna* 71.

Frederick R. Gehlbach
Dept. of Biology
Baylor University
Waco, TX 76798
U. S. A.



Scops Owl *Otus scops*